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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/645,903	08/25/2000	Li Li	3361.2US (97-663.2)	6825

24247 7590 04/03/2007
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EXAMINER

SUCH, MATTHEW W

ART UNIT	PAPER NUMBER
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2891

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	04/03/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary

Application No.

09/645,903

Applicant(s)

LI, LI

Examiner

Matthew W. Such

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 07 August 2006.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 10-31 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 10-20 is/are allowed.
- 6) ☒ Claim(s) 21-23 and 25-31 is/are rejected.
- 7) ☒ Claim(s) 24 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Claim Objections

1. Claims 14, 16, 25 and 27 are objected to because of the following informalities: the claims recite “about 10EC and 80EC” as temperature ranges. The phrase EC is not a unit of measure. The claims should read “about 10° C and 80° C”.

Appropriate correction is required.

2. Claims 11-14 each recite the limitation “performing the nitric acid solution dip at a concentration”. There is insufficient antecedent basis for the limitation of “the nitric acid solution dip” in the claim. The Examiner suggests amending the claim to read “applying the nitric acid solution at a concentration” to improve the clarity of the claim.

3. Claims 21-25 are objected to because of the following informalities: the claims each recite some variation of the following “nitric-acid containing”, “nitric acid-containing” and “nitric acid -containing”. The Examiner suggests choosing a single format for clarity.

Appropriate correction is required.

4. Claims 21 and 26-29 are objected to because of the following informalities: the claims each either “phosphoric acid -containing” or “phosphoric acid-containing”. The Examiner suggests choosing a single format for clarity.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

5. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

6. Claims 22-23 and 25-31 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

7. Regarding claim 22, the specification does not teach the limitations of a partial via to expose a barrier layer, followed by cleaning with phosphoric acid, etching the cleaned barrier layer to form a full via to a metal containing trace, and applying a nitric acid solution to the full via as claimed in claim 21 in combination with a nitric acid solution at a concentration of 50-100% by weight. The specification discloses this combination with 70% by volume only (see Page 10, Line 7). The Applicant is invited to identify where in the specification the combination of limitations of claim 22 is explicitly supported.

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8. Regarding claim 23, the specification does not teach the limitations of a partial via to expose a barrier layer, followed by cleaning with phosphoric acid, etching the cleaned barrier layer to form a full via to a metal containing trace, and applying a nitric acid solution to the full via as claimed in claim 21 in combination with applying a nitric acid solution for a time span of between 10 seconds and 30 minutes. The specification discloses this combination for about 200 seconds only (see Page 10, Line 7). The Applicant is invited to identify where in the specification the combination of limitations of claim 23 is explicitly supported.

9. Regarding claim 25, the specification does not teach the limitations of a partial via to expose a barrier layer, followed by cleaning with phosphoric acid, etching the cleaned barrier layer to form a full via to a metal containing trace, and applying a nitric acid solution to the full via as claimed in claim 21 in combination with applying a nitric acid solution at a temperature of between about 10-80 degrees Celsius. The specification does not disclose this combination. The Applicant is invited to identify where in the specification the combination of limitations of claim 25 is explicitly supported.

10. Regarding claim 26, the specification does not teach the limitations of a partial via to expose a barrier layer, followed by cleaning with phosphoric acid, etching the cleaned barrier layer to form a full via to a metal containing trace, and applying a nitric acid solution to the full via as claimed in claim 21 in combination with performing the phosphoric acid solution dip at a concentration of between about 200 volumes of water to about 1 volume of phosphoric acid and about 1 volume of water to about 1 volume of phosphoric acid. The specification discloses this

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combination of about 20:1 volume ratio only (see Page 9, Lines 26-27). The Applicant is invited to identify where in the specification the combination of limitations of claim 26 is explicitly supported.

11. Regarding claim 27, the specification does not teach the limitations of a partial via to expose a barrier layer, followed by cleaning with phosphoric acid, etching the cleaned barrier layer to form a full via to a metal containing trace, and applying a nitric acid solution to the full via as claimed in claim 21 in combination with performing the phosphoric acid at a temperature of between about 10-80 degrees Celsius. The specification discloses this combination of about 35 degrees Celsius only (see Page 9, Line 27). The Applicant is invited to identify where in the specification the combination of limitations of claim 27 is explicitly supported.

12. Regarding claim 28, the specification does not teach the limitations of a partial via to expose a barrier layer, followed by cleaning with phosphoric acid, etching the cleaned barrier layer to form a full via to a metal containing trace, and applying a nitric acid solution to the full via as claimed in claim 21 in combination with performing the phosphoric acid for a time span of between about 10 seconds and 10 minutes. The specification discloses this combination of about 90 seconds only (see Page 9, Line 27). The Applicant is invited to identify where in the specification the combination of limitations of claim 28 is explicitly supported.

13. Regarding claim 29-31, the specification does not teach the limitations of a partial via to expose a barrier layer, followed by cleaning with phosphoric acid, etching the cleaned barrier

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layer to form a full via to a metal containing trace, and applying a nitric acid solution to the full via as claimed in claim 21 in combination with performing the phosphoric acid including a fluorine-containing component such as hydrofluoric acid and ammonium fluoride. The specification does not disclose this combination. The Applicant is invited to identify where in the specification the combination of limitations of claims 29-31 are explicitly supported.

Claim Rejections - 35 USC § 103

14. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

15. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Krautschneider (WO 97/03469; the Examiner refers to English equivalent US 5,943,572 for the purposes of the present Office Action) in view of Hu (US 5,511,020).

16. Regarding claim 21, Krautschneider teaches a method of forming a via in a dielectric layer (Element 5; Figs. 2-3) and an underlying barrier layer (Element 6; Figs. 2-3) for a semiconductor device, such as a flash memory. A partial via (Element 4; Figs. 2-3) is formed in the dielectric layer to expose at least a portion of the barrier layer (Fig. 2). The partial via is cleaned with a phosphoric acid containing solution (Col. 6, Lines 55-60). The barrier layer is

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etched with a nitric acid containing solution after the cleaning (Col. 6, Lines 61-65) forming a full via containing a trace (Element 6'; Fig. 3) on the bottom surface thereof. Since the nitric acid containing solution is applied to the full via the instant etching is completed.

Krauschneider teaches that the trace (Element 6') is a polysilicon floating gate electrode for a memory cell and does not teach that the trace is a metal containing material.

Hu teaches using polysilicon, silicide (metal containing polysilicon) and metal materials as floating gate electrodes in memory cells (Col. 4, Lines 2-4 and 33-35). It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the floating gate trace of Krauschneider with, for example, a metal containing material such as a silicide, as taught by Hu since the materials are conventional functional equivalents for floating gate electrodes in memory cells. It has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. The selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination in *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945) See also *In re Leshin*, 227 F.2d 197, 125 USPQ 416 (CCPA 1960). MPEP § 2144.07.

Terminal Disclaimer

17. The terminal disclaimer filed on 7 December 2005 disclaiming the terminal portion of any patent granted on this application which would extend beyond the expiration date of US

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Patent No. 6,576,547 B2 has been reviewed and is accepted. The terminal disclaimer has been recorded.

18. The terminal disclaimer filed on 7 December 2005 disclaiming the terminal portion of any patent granted on this application which would extend beyond the expiration date of US Patent No. 6,828,228 B2 has been reviewed and is accepted. The terminal disclaimer has been recorded.

Allowable Subject Matter

19. Claims 10-20 are allowed.

20. Claim 24 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

21. The following is an examiner's statement of reasons for allowance of claims 10-20: A search of the prior art does not disclose or reasonably suggest a method of removing oxide and metal polymer from a opening in a dielectric layer with a metal-containing layer therein by applying nitric acid followed by phosphoric acid.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue

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fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

22. The following is a statement of reasons for the indication of allowable subject matter: A search of the prior art does not disclose or reasonably suggest a method of forming a via in a dielectric layer and underlaying barrier layer by forming a partial via exposing the barrier layer and cleaning the partial via with phosphoric acid, followed by etching to barrier layer to form a full via have a metal-containing trace on the bottom surface and applying nitric acid for 200 seconds.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew W. Such whose telephone number is (571) 272-8895. The examiner can normally be reached on Monday - Friday 9AM-5PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bradley W. Baumeister can be reached on (571) 272-1722. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Matthew W. Such
Examiner
Art Unit 2891

MWS
3/27/07



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